

An Investigation Of Physics Education Doctoral Dissertations Made In Turkey Between 2010 And 2015

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ABSTRACT

The purpose of this study was to investigate doctoral dissertations on physics education conducted in Turkey between the years of 2010 and 2015. The year, institution, language, researcher's gender, advisor position, research design and method, number and properties of samples, subject, data collection tools and theme distribution of the doctoral studies were investigated. The document analysis technique, which is a qualitative research method, was used. The population for research was all doctoral dissertations in the field of physics education at various institutes in Turkey. The sampling group consisted of 78 dissertations accessed through the online National Thesis Centre. To collect data, a form of structure determination developed by the researcher was used. Data were analysed with categorical analysis techniques. The findings indicated that the number of physics education doctoral dissertations has increased when compared with the number of dissertation made in the years 2001-2009. Most of these doctoral dissertations were conducted at Karadeniz Technical University and Middle East Technical University, with a mixed research method preferred by researchers. In general, high-school students and pre-service teachers were the sample for these dissertations. The theme of success and attitudes were the most frequent research topics used in dissertations on physics education.

INTRODUCTION

The investigation of historical development of scientific knowledge is needed to reveal the point where such knowledge becomes available and open to new forms of research. The point where scientific knowledge becomes a source of new research shows how much knowledge is available before that point (Bağ, Kara & Uşak, 2002). New studies related to special fields of education and new researchers, known as field educators, show these fields have developed. However, new researchers have some limitations in the field of education and in finding previous studies published in Turkey (Karamustafaoğlu, 2009). However, the construction of special departments within in education faculties can speed up development.

One developing field is physics education, which differs from physics departments and the faculties of arts and sciences in how academicians work, think and are interested in education. With the development of physics education in universities, fundamental changes have been made in instructional programmes in Turkey. For example, the instructional physics programme in high schools changed based on constructivism in 2004 (Çakıcı ve Ilgaz, 2011); this was strengthened with the reconstruction of the programme in 2011.

Developments in physics education and in instructional programmes are also reflected in doctoral dissertations. The first physics education doctoral dissertation in Turkey was published in 2001 (Doğru, Gençosman, Ataalkın & Şeker, 2012), which shows that the history of doctoral dissertations in the field of physics education goes back approximately 15 years. An increase in the number of doctoral dissertations on a subject is important for understanding how the field has developed and finding out where it is now and where it is going (Göktaş ve Erdem, 2006). In this context, there are some studies (Balcı, 2004; Altıparmak & Nakiboğlu, 2005; Gürdal, Bakioğlu & Öztuna, 2005; Çakıcı & Ilgaz, 2011; Doğru, Gençosman, Ataalkın & Şeker, 2012; Çeliker & Uçar, 2015) that investigate doctoral dissertations in Turkey.

The literature review of these studies gives three main points. First, until now master theses were mostly searched for and investigated through many variables. However, doctoral dissertations are not searched for in the same way as a master's thesis. This could be because the publishing language of some dissertations is English and there are access limitations from the doctoral dissertations' own researchers. At present, access to doctoral dissertations is easier than in past with the use of the National Thesis Centre of Higher Education Institutions. In a study conducted by Doğru, Gençosman, Ataalkın & Şeker (2012) looked at doctoral dissertations before 2009. An investigation of doctoral dissertations from 2010 to the present is needed. Because of the one-year access

limitations of doctoral dissertations, this study was conducted to investigate doctoral studies between 2010 and 2015. Second, when accessing dissertations from the National Thesis Centre, more than one keyword should be used to find dissertations on a specific field. Some dissertations could not be found just through the keywords “physics education” or “physics teaching” because the dissertations were indexed in the fields of physics or engineering. As a result, the searched keywords were carefully selected to find all physics education dissertations. Finally, the independent variables searched in the studies were listed. The year, institution, language, researcher’s gender, advisor position, research design and method, number and properties of samples, subject, data collection tools and theme distribution of the doctoral studies were investigated. As a result, for Turkish doctoral dissertations on physics education between 2010 and 2015 the following questions were investigated:

- What was the distribution in terms of years?
- What was the distribution in terms of institutions?
- What were the languages?
- What was the distribution of researchers’ genders?
- What was the distribution of advisor positions?
- Which designs or techniques were used?
- Which research methods were used?
- What were the sample sizes and properties?
- Which physics subjects were studied?
- Which data collection tools were used?
- Which themes were used?

AIM OF THE STUDY

The purpose of this study was to investigate physics education doctoral dissertations published in Turkey between the years of 2010 and 2015. The year, institution, language, researcher’s gender, advisor position, research design and method, number and properties of samples, subject, data collection tools and theme distribution of the doctoral studies were investigated.

METHOD

The document analysis technique, which is a qualitative research method, was used to investigate the doctoral dissertations in physics education between the years of 2010 and 2015. The technique covers the analysis of written materials containing information about the targeted case or cases and has five steps: (1) finding documents, (2) controlling originality, (3) understanding documents, (4) analysing data and (5) using data (Yıldırım & Şimşek, 2013).

During the study, the National Thesis Centre’s online search engine was used to access doctoral dissertations on physics education. First, the years 2010 to 2015 and the situation of doctoral dissertations were selected. Second, the dissertations that used an English or Turkish physics word in the title or abstract were searched. Third, the dissertations that had access permissions and were in the category of education and training were listed. Finally, the list of titles was checked and the dissertations related to physics education field were selected for inclusion. A total of 78 doctoral dissertations were accessed this way; all were downloaded.

To collect data, the researcher developed a form of structure determination. This contained all independent variables: year, institution, language, researcher’s gender, advisor position, research design and method, number and properties of samples, subject, data collection tools and themes. A total of 78 doctoral dissertations were investigated this way. The data were then coded into a computer to make categorical analysis. The collected data are presented in the findings of this study.

FINDINGS

The distributions of doctoral dissertations in terms of years, institutions, the language used, the distributions of researcher’s gender and advisor positions, designs, techniques and methods used, sample sizes and sample properties, physics subjects studied, data collection tools and themes are listed below.

- What was the distribution of doctoral dissertations in terms of years?

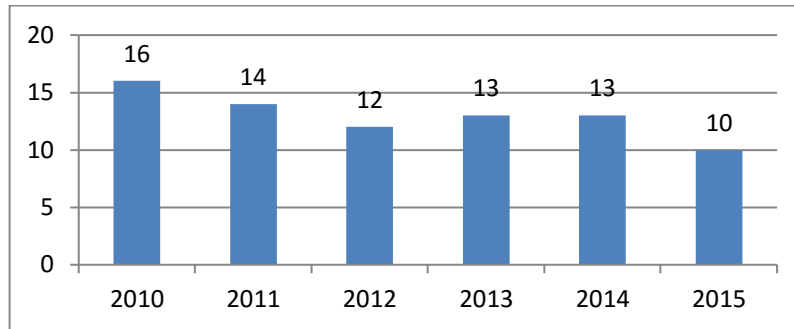


Figure 1. The distribution of doctoral dissertations in terms of years

According to Figure 1, there are 78 doctoral dissertations on physics education between 2010 and 2015. The highest number of dissertations was published in 2010 and the lowest in 2015. The decrease could be a result of the one-year access permission for doctoral dissertations. The average number of doctoral dissertations per year between 2010 and 2015 is 13.

- What was the distribution of doctoral dissertations in terms of institutions?

Table 1: The distributions of doctoral dissertations in terms of institutions

University	Number	%
Karadeniz Technical University	16	21
Middle East Technical University	15	19
Gazi University	9	12
Atatürk University	8	10
Balıkesir University	7	9
Marmara University	6	8
Dicle University	3	4
Dokuz Eylül University	3	4
Ankara University	2	3
Hacettepe University	2	3
Selçuk University	2	3
Celal Bayar University	1	1
Dumlupınar University	1	1
Ege University	1	1
Fırat University	1	1
Trakya University	1	1

Table 1 shows the distributions of doctoral dissertations in terms of institutions. There are 16 universities in Turkey that published doctoral dissertations on physics education. Karadeniz Technical University (21%) and Middle East Technical University (19%) published the most; Celal Bayar University, Dumlupınar University, Ege University, Fırat University and Trakya University published the fewest.

- What were the languages of doctoral dissertations?

Of the 78 doctoral dissertations, 15 (19%) were in English and 63 (81%) were in Turkish. Only the doctoral dissertations from the Middle East Technical University were in English.

- What was the distribution of researchers' genders in doctoral dissertations?

Of 78 doctoral dissertations, 45 (58%) were by males and 33 (42%) were by females; the number of male researchers is higher than the number of females.

- What was the distribution of advisor positions in doctoral dissertations?

In total, 35 professors (45%), 23 associate professors (30%) and 13 assistant professor doctors (17%) participated as an advisor on physics education. Four doctoral dissertations used double advisors: professor/associate professor, associate professor/assistant professor doctor, doctor/assistant professor doctor and assistant professor doctor/instructor.

- Which designs or techniques were used in the doctoral dissertations?

Table 2. The distribution of designs/techniques used in doctoral dissertations

Research design	Number	%
Pre-test/post-test control group design	42	53
Case study	15	19
One group pre-test/post-test design	6	8
Content analysis	4	5
Factor analysis	3	4
Survey study	2	3
Document analysis	2	3
Other	6	8

According to Table 2, the doctoral dissertations used 14 different research designs and the pre-test/post-test control group design was preferred. The 'other' category includes meta-analysis, phenomenological research method, longitudinal developmental research methods, didactic engineering research theory, material and test development.

- Which research methods were used in doctoral dissertations?

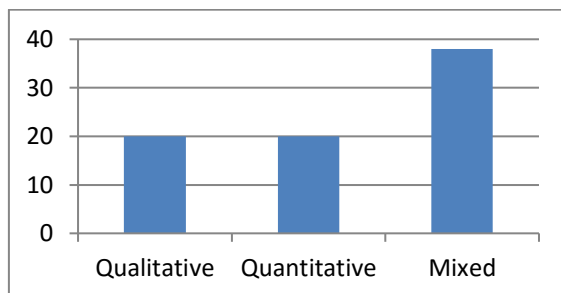


Figure 2. Research methods in doctoral dissertations

As in Figure 2, the mixed method ($f=38$, 48%) was most used in doctoral dissertations. The number of qualitative studies ($f=20$, 26%) was equal to the number of quantitative studies ($f=20$, 26%).

- What were the sample sizes and sample properties of doctoral dissertations?

Table 3: The Distribution of sample properties, number of dissertations and sample sizes

Sample properties	Number of dissertations	Sample size
High school students	34	4533
Pre-service teachers	36	2954
Teachers	14	1189
Parents	1	196
Articles	1	77
Doctoral dissertations	1	25
Doctoral students	1	10
Administrators	1	2
Books	1	1

According to Table 3, high-school students and pre-service teachers were preferred participants in doctoral dissertations. The numbers of studies conducted with parents, articles, doctoral dissertations, doctoral students, administrators and books were very low.

- Which physics subjects were studied in doctoral dissertations?

Table 4: Physics subjects studied in doctoral dissertations

Subjects	Number	%
Mechanics – force and motion	16	20
Electricity	14	18
Modern physics	6	8
Work and energy	5	6
Magnetism	5	6
Heat and temperature	2	3
Optics	2	3
Waves	1	1
Electrostatics	1	1
Impulse and momentum	1	1
Radioactivity	1	1
Sound	1	1
Torque and angular momentum	1	1
No subject	22	28

Table 4 shows the distribution of physics subjects in doctoral dissertations. Of the 78 doctoral dissertations, 22 (28%) did not cover any physics subjects. Mechanics (20%) and electricity (18%) were the preferred subjects.

- Which data collection tools were used in doctoral dissertations?

Table 5: Data collection tools used in doctoral dissertations

Tool	Number	%
Achievement test	48	26
Interview form	39	21
Attitude scale	22	12
Observation form	21	11
Special tools	16	9
Survey	11	6
Science process skills test	10	5
Other scales	9	5
Other tests	4	2
Misconception test	3	2

According to Table 5, 10 data collection tools were used 183 times in 78 doctoral dissertations. This shows that on average more than two tools were used in each dissertation. Achievement tests were the preferred data collection tool followed by interview forms and attitude scales. Misconception tests were used the least, which suggests they could be coming to an end within physics education.

- Which themes were used in doctoral dissertations?

According to Table 6, 66 themes were used 195 times in 78 doctoral dissertations. Thus, an average of 2.5 themes were used in doctoral dissertations. Achievement and attitudes were the most used themes in doctoral studies.

Table 6: Themes used in doctoral dissertations

Theme	N	%	Theme	N	%	Theme	N	%
Achievement	41	21	Learning styles	2	1	Cooperative learning	1	1
Attitude	22	11	Pedagogical content knowledge	2	1	Comparative education	1	1
Computer-based learning	9	5	Problem solving performances	2	1	Concept understanding	1	1
Material development	8	4	Simulation	2	1	Concept maps	1	1
7E instructional model	6	3	Inquiry learning	2	1	Conceptual change texts	1	1
5E instructional model	5	3	Drama	2	1	Conceptual physics problems	1	1
Science process skills	5	3	Mental model development	2	1	Laboratory methods	1	1
Modern physics	5	3	4mat teaching method	1	1	Mathematical modelling	1	1
Problem-based learning	5	3	Academic self-concept	1	1	Meta-analysis	1	1
Web-based learning	5	3	Active learning	1	1	Model based learning	1	1
Context-based learning	4	2	Meaning making processes	1	1	Modelling	1	1
Physics instructional program	4	2	Analogical modelling	1	1	Out of school activities	1	1
Misconceptions	4	2	Augmented reality	1	1	Literacy activities	1	1
Self-sufficiency	4	2	Science history based learning	1	1	Teaching applications	1	1
Project-based learning	3	2	Course book	1	1	REACT learning strategy	1	1
Constructivism	3	2	Affective characteristics	1	1	Hot conceptual change theory	1	1
Peer instruction	2	1	Physics experiments	1	1	Technological pedagogical content knowledge	1	1
Thought experiment	2	1	Physics courses	1	1	Test development	1	1
Critical thinking	2	1	Physics laboratory	1	1	Learning science by typing	1	1
Epistemological belief	2	1	Physics and music relationship	1	1	Creativity	1	1
Professional developmental program	2	1	Blind students	1	1	Mode-method interaction	1	1
Motivation	2	1	Internet-based learning	1	1	Method-approach interaction	1	1

CONCLUSIONS AND DISCUSSION

The aim of the study was to investigate 78 doctoral dissertations on physics education published between the years of 2010 and 2015. Document analysis was carried out for the dissertations; this is one of the most commonly used qualitative research methods. The conclusions of the study are as follows:

- The average number of dissertations published each year between 2010-2015 is 13. There were 2,6 between 2001 and 2009 according to the study conducted by Dođru, Gençosman, Ataalkın ve Şeker (2012). So the increase in the number of average dissertations shows interest in physics education is growing.

- There were 16 universities that produced physics education dissertations; Karadeniz Technical and Middle East Technical Universities published the most. Literature on this figure for previous (before 2010) the earlier years was not found; however, the number of universities is increasing as more people graduate with doctorate degrees in physics education and choose to work in this field. That could be why these universities produced more dissertations than others. Additionally, these universities are older (Çetinsaya, 2014).
- Most doctoral dissertations were published in Turkish; only dissertations published by the Middle East Technical University (METU) were in English. At METU lessons are taught in English; the others teach in Turkish.
- 58% of dissertations were written by males with the rest by females. The findings also indicated that the advisors of these dissertations were mainly professors (45%).
- The mixed method and pre-test/post-test control group design were the preferred research design and method. When these findings were compared with Doğru et al's study, it can be seen that the percentage of these methods and designs has increased. Quantitative research methods were used the most between 2001 and 2009; this then changed to mixed research methods. Çeliker and Uçar (2015) state that in science and technology dissertations, pre-test/post-test control group design was used the most, which is similar to this study.
- Similar to Doğru et al's study, electricity and mechanics were the most-studied subjects in physics education. However, while there were seven dissertations on physics education about these subjects until 2009, this study demonstrated that this number increased to 30.
- Achievement tests, interview forms, attitude scales and observation forms were most-selected data collection tools.
- According to Karadağ (2009), physics education studies have not spread because there were limited themes in doctoral dissertations. However, this study found 66 different themes in doctoral dissertations while Doğru et al found just 20 themes between 2001 and 2009. So it can be concluded that physics education studies becoming more widespread.

In conclusion, these findings indicate that physics education is developing with studies scattered over a wide range in terms of both study topics and study methods. The number of doctoral dissertations and the themes within them are increasing. Still, achievements and attitudes are the most-used themes that are repeated in doctoral studies as discussed in Karadağ (2009). The recommendation for academics is to repeat these reviews every five years because this kind of review may be beneficial for other academics to see where we are in physics education. The recommendation for doctoral students is that studies should be high quality and themes should be chosen to reach the wider field of physics education.

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